The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational and Social Sciences (EPESS), 2025

Volume 46, Pages 91-98

IConETE 2025: International Conference on Education in Technology and Engineering

Innovative Approach to Teaching Through Project-Based Learning and the Use of Information Technologies and Tools

Denis Chikurtev
Institute of Information and Communication Technologies

Ava Chikurteva
Institute of Information and Communication Technologies

Ivan Garvanov
University of Library Studies and Information Technologies

Abstract: The field of education has undergone significant changes in recent years. The transition to distance learning during the years of isolation from COVID19 has led to a real and large-scale application of modern information and communication technologies in the processes of training and assessment. Then came the large language models that are widely used to generate knowledge and responses. This application of new methods has shown the advancement of technology and the readiness of the education system and educators to use these technologies. As a result, new teaching and assessment practices have been established, with more active involvement of innovative teaching methods such as project-based learning, flipped classroom and others, which are very successfully applied with the help of ICT. This study presents an innovative approach that combines standard teaching methods such as lectures and seminars, innovative methods such as project-based learning and the application of information technology. The purpose of the study is to present the application of the method and the results obtained from the assessment of students who are trained in the discipline of Computer Architectures. The method was applied to 5 groups of first-year students in different specialties, after which a comparison of the results was made compared to the grades obtained from the previous academic year, when it was taught according to a standard method through lectures, exercises and abstract. The results obtained show an increase in the average grade of students trained in the innovative approach.

Keywords: Project-based learning, E-learning, Computer architecture, ICT

Introduction

Modern education has changed significantly since the advent of large language models such as ChatGPT and Gemini. Students actively use information that gives them these language models and rely entirely or mainly on them (Berdiyeva, 2024). This is a serious problem for educational systems around the world, because they are starting to rely on chatbots and the building of in-depth theoretical knowledge and practical skills in students is lost (Adeleye, 2024). In addition, the use of chatbots leads to reduced interest in attending lecture courses and exercises during the learning process.

On the other hand, distance learning and testing is actively applied, which, despite the use of modern technologies, is not quite a reliable and high-quality approach to achieving good results (Singh et al., 2024). Students are once again relying on chatbots to solve their tasks. The need to master the learning material is reduced or completely eliminated (Li & Wang 2024). These problems in education will lead to bad consequences for future generations. Approaches and methods should be sought to reduce the impact of large language models by developing innovative approaches that integrate both traditional teaching methods and innovative methods (Matjanov, 2024;

Sivarajah, 2019). In addition to these approaches, modern information technologies and tools should be included to serve as an incentive for students to apply usage skills, creativity and problem-solving knowledge (Serik & Nurgaliyeva, 2025). Chatbots could be included as an essential tool for generating guidance and possible solutions so as to support problem-solving processes (Hwang & Chang 2023).

In this study, we present an innovative teaching approach that combines traditional and innovative teaching methods in combination with the use of information technology to help students. The aim of this approach is to strengthen students' motivation to solve problems by inviting them to study the theoretical materials and find the solution to a problem on their own using the Project-Based Learning (PBL) method (Rehman, 2023). The method aims to offer a hybrid learning format, reinforcing students' independent work and challenging them to work in groups. In addition, the method has the potential to develop and contribute to the mastery of the skills set in Industry 5.0 (Nayak, 2024).

The proposed approach has been applied in the Computer Architectures course for the 2024/2025 academic year at the University of Library Studies and Information Technologies, Bulgaria. The results achieved from the application of the method were compared with those of the previous school year (2023/2024), when the same teachers used traditional teaching methods. The subject is studied in five different specialties of the Faculty of Information Sciences: Computer Science (CS), Information Technology (IT), Information Security (IS), Computer Science and Information Brokerage (CSIB) and Information Technology in Institutional and Corporate Environments (ITCE). The publication is structured in the following chapters: Chapter 2 presents the innovative approach to teaching and compares it with the traditional one. Chapter 3 presents the results obtained from the innovative approach and from the traditional approach. Chapter 4 describes the conclusions of the results obtained and guidelines for improving the learning process. Chapter 5 presents a conclusion and ideas for future research.

Teaching Methods

Traditional Method of Teaching

For better clarity, we present a description of a standard teaching method used in the previous school year (Figure 1). Teaching the material using the traditional method includes lectures, exercises and a course project. During the lectures, the lecturer presents the theoretical part of the material, according to a standard approach, through multimedia presentations and on the board. During the exercises, an assistant assists students in completing certain tasks according to a work manual. In addition to the exercises, consultations are held for the preparation of the course project. It usually covers a significant part of the subject curriculum.

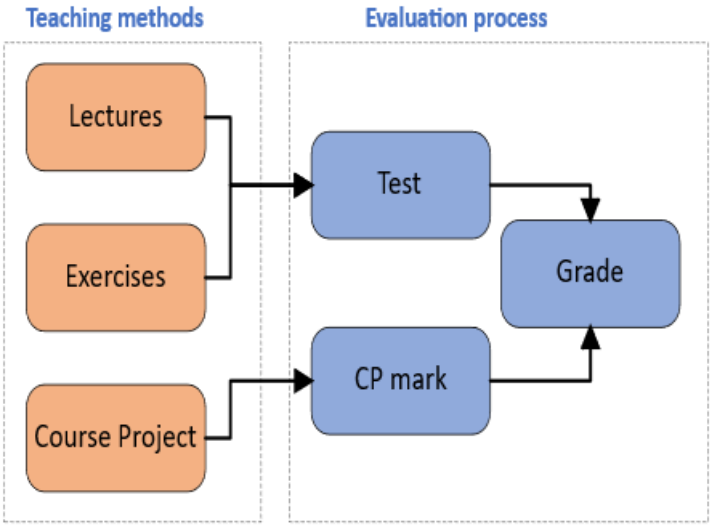


Figure 1. Overview of the elements of the standard teaching method

The assessment of students is formed as an arithmetic average grade of two grades: a test and a course project. The test includes both open-ended and multiple-choice questions and covers the material from the lectures and exercises. The test assesses students' theoretical knowledge. The assessment of the course project mainly refers to the degree of solution of the problem posed and, to a lesser extent, to the layout of the work as a document. Coursework assesses students' practical knowledge and document preparation skills.

Innovative Teaching Method

This method basically changes the way the course project is implemented. In this case, it is implemented by applying the method of project-based learning (PBL) (Zhang & Ma, 2023). Figure 2 shows a flowchart that shows the integration of the PBL. The exercises hours will be reduced in order to expand the hours for working in the project and provide consultation by the assistant or lecturer. The approach presented includes the following elements:

- Lectures: the leading lecturer presents the theoretical part of the material in an auditorium, through multimedia presentations, videos and notes.
- Exercises: an assistant sets assignments in class that students complete according to previously provided manuals. Weekly consultations are held on a given project.
- Project assignments through project-based learning: groups of students are formed who have to solve a complex problem on the topic of the subject using the lecture materials, study additional materials provided by a lecturer or on the Internet, prepare the relevant documentation and present the results achieved. Students must distribute the tasks among themselves, plan their implementation over time, describe the solution and the results achieved in a document and present the project to the teacher.

The assessment in this approach is again an arithmetic mean assessment of two assessments: a test and a project. The test score, again as in traditional training, shows the theoretical knowledge of the students. And the assessment from the project, in addition to individual practical skills for solving problems, evaluates teamwork, skills for distributing tasks, mansions for preparing documents and presentation skills. Thus, the innovative approach aims to strengthen the soft skills of students, which in the traditional method of education are covered in very small aspects. In addition to the assessment by the PBL method, the presence of students during exercises, their activity and desire to solve the tasks are taken into account.

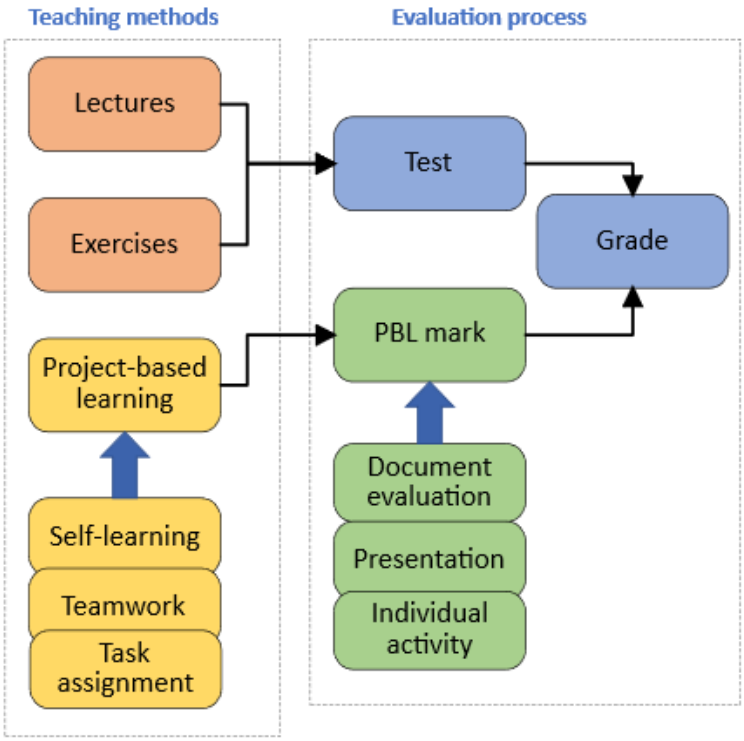
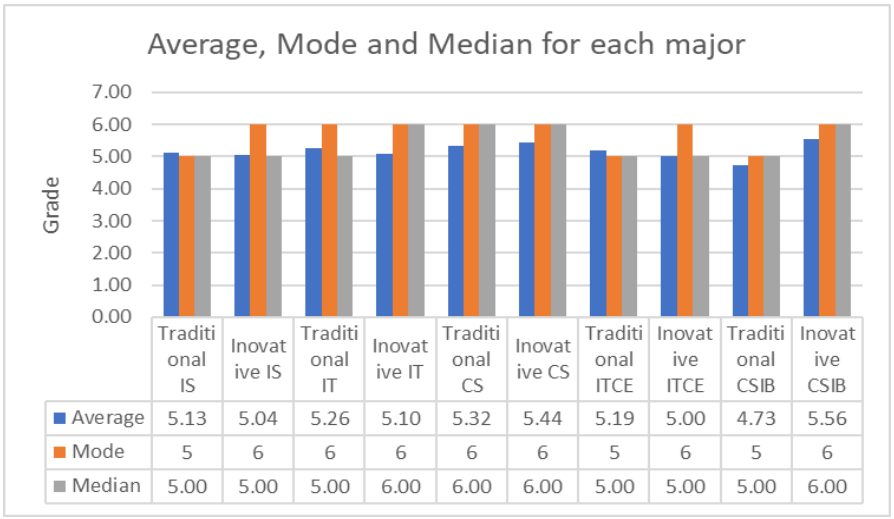


Figure 2. Innovative teaching method elements.

Presentation of the Results of the Assessment

The assessment covers a total of 287 students, with 137 for one academic year and 150 for the other academic year. The large number of tested students allows for reliable validation of the results. A six-point grading system is used, which includes grades from 2 to 6. The graph presented in Figure 3 shows the final grades for each specialty, respectively taught using traditional and innovative methods. Results for PBL, module and median are presented.



	Traditional IS	Inovative IS	Traditional IT	Inovative IT	Traditional CS	Inovative CS	Traditional ITCE	Inovative ITCE	Traditional CSIB	Inovative CSIB
Average	5.13	5.04	5.26	5.10	5.32	5.44	5.19	5.00	4.73	5.56
Mode	5	6	6	6	6	6	5	6	5	6
Median	5.00	5.00	5.00	6.00	6.00	6.00	5.00	5.00	5.00	6.00

Figure 3. Comparison of the final grades for each specialty.

Figure 4 shows the achieved arithmetic mean grades again for each of the two teaching methods, but for all specialties. Here, the average score obtained from the innovative method slightly exceeds that of the traditional one. This result is due to the unevenly distributed number of students in different specialties. Statistical information on the total number of students evaluated and their results is presented in Figures 5 and 6. Figure 5 shows the distribution of grades from the application of the innovative approach, and Figure 6 shows the distribution of grades from the application of the traditional learning approach.

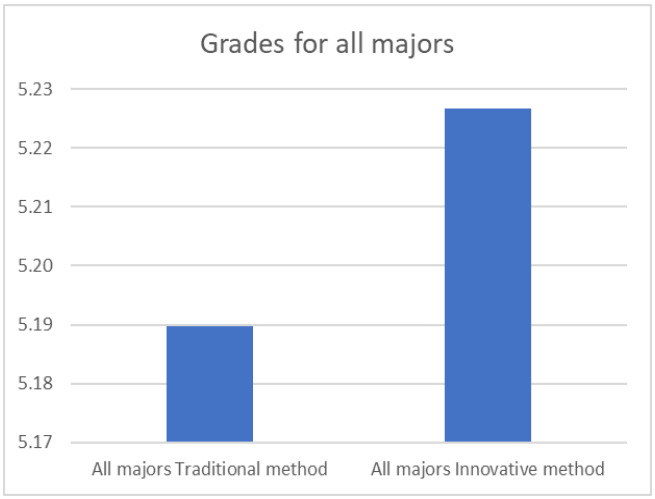


Figure 4. Comparison of final grades for the different methods.

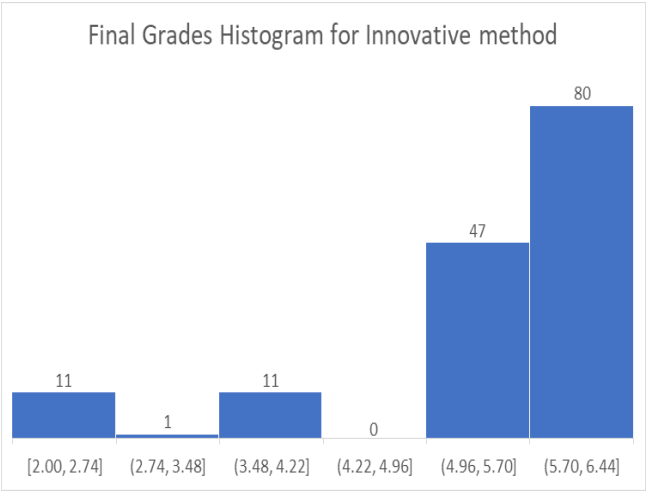


Figure 5. Distribution of grades from the application of the innovative approach.

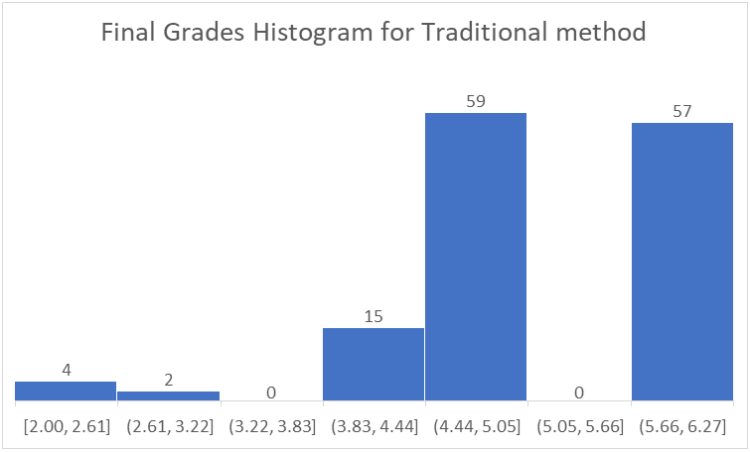


Figure 6. Distribution of grades from the application of the traditional learning approach.

In order to analyze and compare the role of the applied method of project-based learning and the standard implementation of a course project, we present the graphs in Figure 7. Here again the avarage grade, module and median of the grades only for the course projects are given.

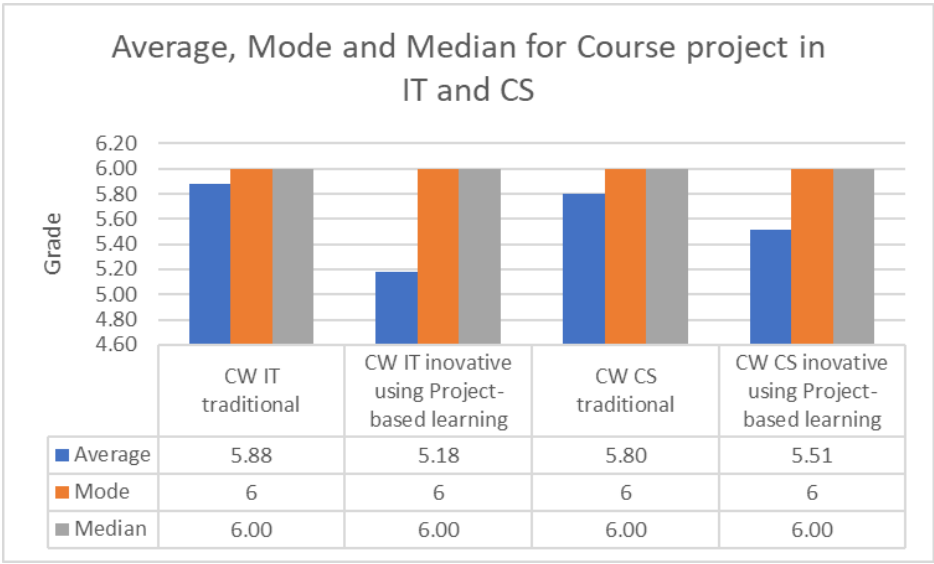


Figure 7. Grades only for course project and PBL, for IT and CS specialties.

The statistical information for the distribution of assessments is presented in Figures 8 and 9, respectively for the innovative approach based on the PBL and the traditional approach. The sample of grades from coursework is only for students of these specialties, as they represent about 60% of all grades and these are the most advanced specialties in the University.

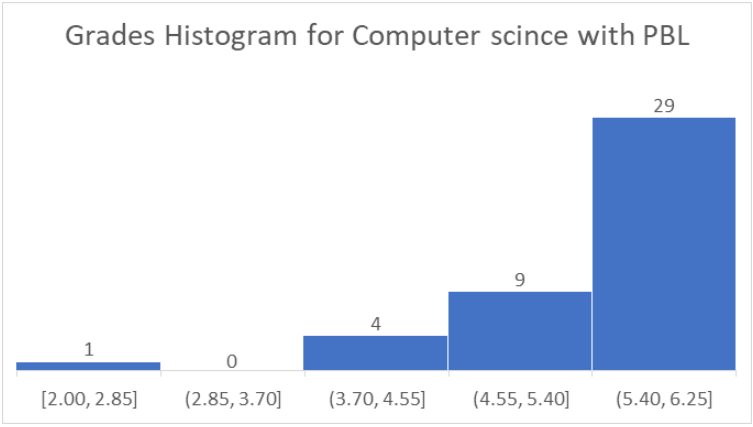


Figure 8. Distribution of assessments for the innovative approach.

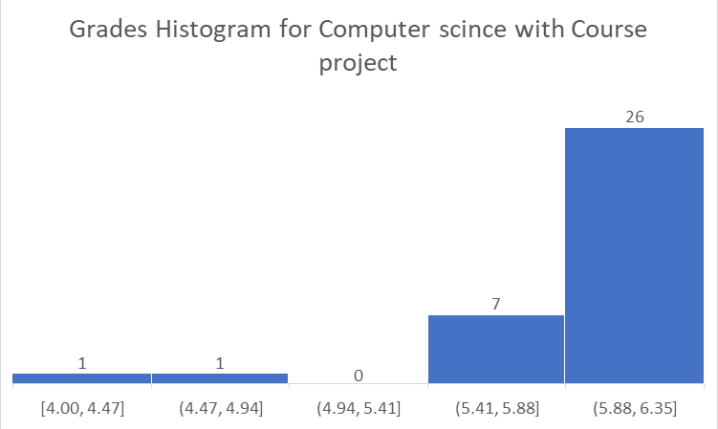


Figure 9. Distribution of assessments for the standard approach

Analysis of Results

- Traditional method: The average score is *5.19*.
- PBL method: The average score is *5.23*.
- Difference: The average score in the PBL method is *0.04* points higher than in the traditional method.

This difference shows that students trained with the proposed teaching method achieve slightly higher scores, albeit minimal.

Distribution of Grades

- Distribution of grades under the traditional method:
  - The most common rating (fashion) is 6.00.
  - There are a significant number of students with grades between 5.00 and 6.00, but there are also students with low grades (2.00 and 3.00), indicating a wider range of academic performance.

- Distribution of assessments under the PBL method:
  - The most common grade (fashion) is again 6.00, but the number of students with excellent grades is higher than with the traditional method.
  - The distribution is more concentrated at the upper end of the scale (5.00-6.00), with much less low scores. This implies a higher overall success rate and fewer failures.

Comparison of Results by Specialty

To better understand whether the teaching method affects different groups of students, we compare the average grades by specialty.

Table 1. Average grades by specialty

Specialty (legend)	Average score (Traditional method)	Average score (PBO method)
IS (Information Security)	5.13	5.04
IT (Information Technologies)	5.26	5.10
CS (Computer Science)	5.32	5.44
ITCE (IT in Corporative Env.)	5.19	5.00
CSIB (CS and Information Brokery)	4.73	5.56
IS (Information Security)	5.13	5.04
IT (Information Technologies)	5.26	5.10
CS (Computer Science)	5.32	5.44

The results show that a variable outcome is observed. In the specialties IS, IT and ITCE, there is a decrease in final success. In SC and CSIB specialties, there is an increase in the average grade.

Comparison of Coursework Results

There is a decrease in here, but the trend of predominant grades 6 remains. This is mainly due to the many evaluation criteria set out in the project-based method. However, despite the decrease in the average grade from the projects, the average grade point average from the final grades is in favor of the innovative teaching method. From this fact, we can conclude that PBL reinforces students' theoretical knowledge and they achieve higher test scores.

Conclusion

The proposed approach to implementing project-based learning to replace the preparation of standard course projects has the potential to strengthen students' theoretical knowledge and prepare them to deal with various challenges by working in a team and learning to distribute tasks among themselves. The presented approach leads to an increase in the overall success of the discipline from the first year of its application. As future studies, a detailed examination of the assignments and criteria for evaluation of the projects is envisaged. Appropriate additional information technologies will be selected to stimulate student work, including the use of chatbots and other guidance aids.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest

Funding

* This research is conducted as part of project No. KP-06-M75/3 "Research of methods and technologies for digitalization of education", funded by the Bulgarian National Science Foundation (BNSF).

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on Education in Technology and Engineering (www.iconete.net) held in Antalya/Türkiye on November 12-15, 2025.

References

Adeleye, O. O., Eden, C. A., & Adeniyi, I. S. (2024). Innovative teaching methodologies in the era of artificial intelligence: A review of inclusive educational practices. *World Journal of Advanced Engineering Technology and Sciences*, *11*(2), 69-79.

Berdiyeva, S. (2024). Explorıng ınnovative approaches to teachıng. *Modern Science and Research*, *3*(1), 923–927.

Hwang, G. J., & Chang, C. Y. (2023). A review of opportunities and challenges of chatbots in education. *Interactive Learning Environments*, *31*(7), 4099-4112.

Jarilkapovich, M. A. (2024). Use of pedagogical methods based on the modern educational program to increase the effectıveness of educatıon. *European International Journal of Pedagogics*, *4*(6), 26–33.

Li, J., Wang, R. (2024). Retracted article: Determining the role of innovative teaching practices, sustainable learning, and the adoption of e-learning tools in leveraging academic motivation for students' mental well-being. *BMC Psychology, 12,* 163.

Nayak, A., Satpathy, I., & Jain, V. (2024). The project-based learning approach (PBL): Enthralling students through project-based learning approach (PBL) in education 5.0. In *Preconceptions of policies, strategies, and challenges in education 5.0* (pp. 158-174). IGI Global.

Rehman, S. U. (2023, September). Trends and challenges of project-based learning in computer science and engineering education. In *Proceedings of the 15th International Conference on Education Technology and Computers* (pp. 397-403).

Serik, M., & Nurgaliyeva, S. (2025). Enhancing competence in mobile robot development: Integrating robotic technologies for future computer science teachers. *Global Journal of Engineering Education*, *26*(3), 239-245.

Singh, B. & Kaunert, C. (2024). Computational thinking for ınnovative solutions and problem-solving techniques: Transforming conventional education to futuristic ınterdisciplinary higher education. In M. Fonkam & N. Vajjhala (Eds.), *Revolutionizing curricula through computational thinking, logic, and problem solving* (pp. 60-82). IGI Global Scientific Publishing.

Sivarajah, R. T., Curci, N. E., Johnson, E. M., Lam, D. L., Lee, J. T., & Richardson, M. L. (2019). A review of innovative teaching methods. *Academic Radiology*, *26*(1), 101-113.

Zhang, L., & Ma, Y. (2023). A study of the impact of project-based learning on student learning effects: A meta-analysis study. *Frontiers in Psychology*, *14*, 1202728.

Zhang, T., Zhang, Y., & Huang, S. (2024). Exploration and Innovation in practical teaching for computer science majors. *Journal of Social Science and Cultural Development*, *1*(1), 182.

Author(s) Information

Denis Chikurtev
Institute of Information and Communication Technologies – Bulgarian Academy of Sciences, Acad. G. Bonchev str., Sofia, 1113, Bulgaria
Contact e-mail: *denis.chikurtev@iict.bas.bg*

Ava Chikurteva
Institute of Information and Communication Technologies – Bulgarian Academy of Sciences, Acad. G. Bonchev str., Sofia, 1113, Bulgaria

Ivan Garvanov
University of Library Studies and Information Technologies – Bulgaria, 119, Tsarigradsko Shose, Sofia, 1784, Bulgaria

To cite this article:

Chikurtev, D., Chikurteva, A., & Garvanov, I. (2025). Innovative approach to teaching through project-based learning and the use of information technologies and tools. *The Eurasia Proceedings of Educational and Social Sciences (EPESS), 46,* 91-98.